Attachment A

Draft Environmental Impact Statement for Converse County Oil and Gas Project (January 2018)
A technical and scientific assessment of the greater sage-grouse relevant portions of the document
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In order to achieve sage-grouse conservation goals, the BLM and USFS must manage sage-grouse habitats at landscape spatial scales. This need is explicitly established in the ARMPA (pg. 23) where the overriding management goal is to "conserve, restore and enhance sage-grouse habitat on a landscape scale…" One of the primary objectives of developing Environmental Impact Statements (EIS) is to provide analyses "adequate for the purpose of reaching informed decisions regarding Project development" (Draft EIS for Converse County Oil and Gas Project [DEIS]; pg. 1-2). In the context of landscape-scale conservation, informed decision-making requires empirically-based impact assessments done across relevant scales. The following is an assessment of the qualitative and deductive analyses and resulting conclusions for greater sage-grouse (sage-grouse) presented in the DEIS. I provide evaluations of analyses pursued, suggestions for adjustments to analyses, and point out where the analyses could contribute to inaccurate conclusions given the framework of landscape-scale conservation. Although my assessment focuses on the analyses estimating risk of impact of proceeding with Alternative B, the same concerns generally track with Alternative C especially in the context of estimating likely residual impacts in the context of adhering to stipulations (i.e., avoidance and minimization) as is generally the case for Alternative C.

The qualitative analyses used to estimate the potential impact of infrastructure on sage-grouse included an assessment of: (1) the change in infrastructure density within 2 miles of known sage-grouse leks occurring in the Project area; (2) the change in the amount of surface disturbance as a percentage of DDCT assessment areas established in core habitats associated with the Project area; and (3) the change in the level of fragmentation as a change in linear Project components per square mile.

Infrastructure Density:--Assuming a uniform distribution of infrastructure throughout the Project area, it was estimated that each lek (on average) would have 9.9 additional well pads placed within 2 miles under Alternative B (pg. 4.18-63). These estimates were added to the number of existing well pads within the 2-mile buffers, and infrastructure density estimates presented in Doherty et al. (2010) were used to categorically establish that 31 leks (58%) in the Project area would be "moderately" impacted as a result of pursuing Alternative B (pg. 4.18-63). These results led to the conclusion in the DEIS that "development under Alternative B would exceed [the 1 well pad per square mile threshold] of development for 38 of the 46 sage-grouse leks within 2 miles of the [Project area]" (pg. 4.18-63). Although the numbers cited in this sentence do not track from the information provided in this section of the DEIS, the line of reasoning presented suggests that 58 to 83% of the leks in the Project area would be at risk of being abandoned as a result of increased infrastructure densities within 2 miles (see Holloran 2005, Doherty et al. 2010). However, based on the information provided in Doherty et al. (2010; Table 1), more specific estimates of potential impact could have been generated from the analyses presented.

For example, given the estimate of 9.9 additional wells within 2 miles of each lek, the probability of lek abandonment will double for 31 of the 52 leks (60%) listed in Table 4.18-21 (pg. 4.18-51), suggesting that up to 16 of those 31 leks would be abandoned. Combining this result with the "resulting decline in active leks" estimate (-11.5%) provided in Doherty et al. (2010; Table 1) suggests that approximately 4 of those 31 leks would be abandoned, providing a more accurate estimate of 4 to 16 of the 31 leks where the development threshold has been exceeded would become inactive as a result of pursuing Alternative B. Further, based on the lek count information provided in Table 4.18-21 (pg. 4.18-51) and "decline in males on remaining active leks" estimate (-31.4%) provided in Doherty et al. (2010; Table 1), the estimated decline in the total population as a result of pursuing Alternative B would be approximately 20%. This was estimated by establishing the proportion of the total counted population associated with leks where it was predicted that infrastructure densities would surpass the threshold, and multiplying that estimate by -31.4%. This provides a relative and additive estimate of population declines expected (i.e., the population on all leks that remain active following development will decline by an estimated 20%). This admittedly preliminary assessment of impact provides a more tangible goal for developing compensatory mitigation needs (see pg. 4.18-72), discussed in more detail below.

The approach taken in the DEIS of assessing the impact of well pads (as well as my suggested modifications to those estimates) focuses on infrastructure density, but research suggests that the distance from leks to infrastructure, as well as the configuration of infrastructure surrounding leks influence the number of males occupying those leks. Several authors have reported a distance-effect associated with the infrastructure of energy fields whereby sage-grouse are negatively influenced to a greater extent if infrastructure is placed near seasonal habitat with the response diminishing as distances from the habitat to infrastructure increase (Manier et al. 2013). The majority of the research has investigated the response of lekking sage-grouse to energy development, with studies consistently reporting impacts from infrastructure on the number of males occupying leks to approximately 2 miles, with lesser impacts consistently apparent to approximately 4 miles (Holloran 2005, Walker et al. 2007, Tack 2009, Harju et al. 2010, Johnson et al. 2011). Additionally, distance-effects of infrastructure associated with energy developments of between approximately 0.9 and 1.7 miles on average have been noted during nesting, brood-rearing, and winter (Doherty et al. 2008, Carpenter et al. 2010, Holloran et al. 2010, Dzialak et al. 2011, LeBeau 2012, Dinkins 2013, Fedy et al. 2014). Research also suggests that the spatial configuration of infrastructure within landscapes surrounding leks influences male numbers, with leks where wells were clustered in a way that maintained open areas and where infrastructure did not surround the lek having a higher likelihood of remaining active (Holloran 2005, Doherty et al. 2010). Further, changes in the number of males occupying leks situated east (generally downwind) of infrastructure were more negative than those witnessed on leks west of infrastructure (Holloran 2005). These results suggest that increased noise intensity at leks may negatively influence male lek attendance, which is supported by experimental information establishing that sage-grouse avoid leks in response to anthropogenic noise, with intermittent noise (e.g., vehicle traffic) having a greater effect on attendance than continuous noise (e.g., drilling rig; Blickley et al. 2012). These additional considerations suggest that impact estimates resulting from an assessment of changes in infrastructure density within 2 miles of leks should be considered minimums.

Surface Disturbance:--Surface disturbance impacts were established as an estimate of the proportional increase in surface disturbance within DDCT assessment areas established essentially at the scale of core areas located within the Project area (see Figure 4.18-1; pg. 4.18-49). These analyses led to the conclusion that the 5% surface disturbance cap was exceeded in 3 of the 5 core areas situated within the Project area. However, under Alternative B, “development could be approved on a site-specific basis consistent with the DDCT process if found to be under the 5 percent cap” (pg. 4.18-63). This conclusion is correct, and points to the concern with the approach used to estimate impact: the metrics and thresholds established in Wyoming’s sage-grouse management plan (WY SGEO 2015-4) are site-specific, and are not applicable for assessing sage-grouse habitat conditions at larger spatial scales (e.g., the scale of a core area or a Biologically Significant Unit [BSU]). Thus, the DEIS cannot rely solely on the metrics included in the State’s approach (i.e., surface disturbance and infrastructure density) when investigating the potential impacts of a proposed development at larger spatial scales. Additional assessment metrics that can be used to effectively establish the conditions of sage-grouse habitats at these larger scales (e.g., fragmentation statistics; habitat patch size and juxtaposition; connectivity; etc.; Wisdom et al. 2011, Knick et al. 2013, Burkhalter et al. 2018) are worth considering. Also worth noting is that the site-specific metrics developed by the State of Wyoming are relevant only in the situation where management adheres to threshold values (Holloran 2005; Doherty et al. 2010). To be useful in the situation where those thresholds are surpassed, the use of those metrics needs to be modified to account for incremental impacts to sage-grouse populations at infrastructure levels higher than the thresholds (Decker et al. 2017).

Fragmentation:--Again assuming a uniform distribution of infrastructure throughout the Project area, it was estimated that the average length of linear features (used as a proxy for fragmentation in the DEIS) would increase from 1.9 mi/mi^2 of roads, pipelines, and overhead power lines to 3.72 mi/mi^2 in the Project area under Alternative B (pg. 4.18-65). The increase in linear features was not tied to sage-grouse populations in the DEIS. Based on information provided in Knick et al. (2013), most active leks in western portions of the sage-grouse range were in areas with less than 1.6 mi/mi^2 of secondary roads and less than 0.1 mi/mi^2 of overhead power lines. Using information provided by Tack (2009), an estimated 2-fold decrease in the probability of a large lek (>25 males) when road densities increased from 2 to 4 mi/mi^2 would be expected; at 4 mi/mi^2 of road, the probability of a large lek was approximately 18%. Further, "new roads would be constructed and maintained to provide year-round access" (pg. 2-26) and estimates of traffic volumes (pg. 2-33) suggest >4,000 truck trips/day during a majority of the time the field would be in development and production. This suggests that impacts of development would not be isolated to the breeding season (i.e., all seasonal habitats including winter habitats will be impacted by the development). Research indicates that sage-grouse are avoiding human activity (e.g., truck trips) at the time that activity is experienced (Dzialak et al. 2012, Holloran et al. 2015), suggesting that mitigation measures (e.g., timing restrictions if followed) that minimize human activity throughout the life of the potential Project (e.g., using liquid gathering systems; Holloran et al. 2015) may be necessary to minimize impacts of that activity.

Development Planning:--The DEIS assesses levels of impact by species assuming a uniform distribution of development throughout the Project area (e.g., pg. 4.18-1). Based on the distributional pattern of existing infrastructure in the Project area (see Figure 2.3-1), this is more than likely a flawed assumption. This assumption leads to a situation where impact assessments could either be considered worst case (i.e., all leks and habitats impacted a small amount) or best case (i.e., in reality some leks and habitats will be impacted more than estimated); either way the predictions are likely not accurately estimating impact. Although I do not disagree that it is premature at this stage to expect the location of all infrastructure to be known (see pg. 1-5), obvious flaws in assumptions limit effective decision making in the context of the DEIS providing the level of information required to do so. I suggest developing build-out scenarios based on geophysical variables that may influence gas potential (i.e., built from production data of existing wells in the Project area; see Copeland et al. 2009) to establish – in a spatially-explicit manner – the probability of development within the Project area. This would provide the framework for predicting the location of infrastructure in the Project area, which could be combined with other sources of information important to avoidance and minimization measures to establish a more accurate prediction of infrastructure layout. For example, infrastructure will likely be clumped on the landscape relative to resource location, and the horizontal offset potential described in the DEIS (up to 2 miles) suggests that the companies have the technological capacity to clump infrastructure even more than the underlying resource may suggest.

The approach to planning energy developments suggested by the previous paragraph is critically important for sage-grouse, where the likely effects of relatively discrete levels of development may result in large-scale indirect loss of habitat for the species (Copeland et al. 2011, Holloran et al. 2015). The DEIS specifically indicates that "specific estimates of indirect impacts from project components are not possible due to the programmatic nature of this EIS. Indirect impacts to wildlife species and habitats are [therefore] qualitatively described" (pg. 4.18-1). This is problematic. Informative indirect and cumulative impact assessments require that surface locations of proposed infrastructure are at least somewhat established. From these spatially-explicit estimates in the context of existing conditions, the potential response of sage-grouse populations can be predicted; and these predictions are the metric critical for informed decision making. Otherwise proactive approaches to planning development in the context of multiple use cannot be pursued; we are left instead with qualitatively informed conclusions that are not necessarily helpful in decision making. Consider developing from the aforementioned infrastructure placement scenarios a holistic plan for the placement of development (in aggregate) in relation to areas set aside as wildlife refugia (also in aggregate) throughout the project area. Use these scenarios to inform avoidance, minimization and mitigation to reduce impact to sage-grouse of development while allowing for the full development of the resource (see for example Kirol et al. 2015). Further, within the context of this plan, I suggest re-considering some of the development Alternatives eliminated from consideration (section 2.6), especially phased/concentrated development (pg. 2-46). This approach to planning development would generate more empirically-based information for decision making, and better inform avoidance, minimization, and compensatory mitigation needs at the scale of the Project area.

Invasive Plants:--The DEIS identifies cheatgrass as being pervasive across the Project area, and mentions that in some areas of the Project area cheatgrass is the dominant herbaceous species (pg. 3.14-6). The approach established in the DEIS to managing invasive annual grasses is to limit "further expansion of areas already affected by invasive plant species" (pg. 4.14-5) by arranging for infestations to be mapped to assist land management agencies in the development of treatment plans (pg. 4.14-11). Although it is acknowledged in the DEIS that adherence to Federal protocols "would not completely eliminate the threat of invasion and spread of invasive plant species" (pg. 4.14-12) and that "populations of weedy annual species may become established" for extended periods of time (pg. 4.14-15), the conclusion rendered for cheatgrass in the DEIS is that infestations would be temporary, localized and reversible (pg. 4.14-12 and 4.14-15).

By changing fire-frequency, cheatgrass infestations cause the direct elimination of native shrubs, forbs, and perennial grasses and result in self-perpetuating stands of cheatgrass (Chambers et al. 2007). Next to habitat destruction, invasive plants are considered the second-most important threat to rangeland biodiversity, with many shrub-dominated rangelands throughout the western U.S. having been converted to monocultures of cheatgrass that are now considered steady states (i.e., are irreversibly altered; Sedgwick 2004, Miller et al. 2011). Given restoration technology and knowledge, these altered landscapes are currently considered indefinitely lost as sage-grouse habitat. As a consequence, most land managers emphasize that extreme caution and discretion need to be employed when proposing actions that disturb drier Wyoming big sagebrush sites, especially in areas where cheatgrass may become established and/or spread (as is the case in the Project area; e.g., Connelly et al. 2004, Bohne et al. 2007). Because of this, cheatgrass proliferation in the Project area cannot be considered reversible, and the potential for the indefinite elimination of substantial amounts of sage-grouse habitat must be considered a short-term impact that could result in irreversible long-term degradation. This further suggests that the potential for cheatgrass to become established for extended periods of time (pg. 4.14-15) should be considered residual, warranting compensatory mitigation. Consider taking a more proactive approach to managing invasive plants, especially invasive annual grasses, than the approach described in the DEIS (pg. 4.14-11). I encourage the development and implementation of a comprehensive weed management plan for the Project area following Ecologically Based Invasive Plant Management principles (http://www.ebipm.org/). The University of Wyoming and Agricultural Research Service (USDOA) have tremendous expertise that could assist in this effort.

Residual Impacts:--The impact information presented in the DEIS was used to conclude that: "Alternative B would result in impacts to special status wildlife species associated with surface disturbance, habitat fragmentation, human disturbance, and the potential for granting of exceptions to timing limit stipulations," and in the case of sage-grouse, "all leks in the [Project area] would be at risk of being abandoned" as a result of development (pg. 4.18-72). These impacts were considered residual in the case of sage-grouse for Alternative B, warranting compensatory mitigation. However, it was further suggested in the DEIS that “oil and gas development would have localized impacts on [special status terrestrial] wildlife populations” and that special status wildlife habitat impacted during development could return to pre-disturbance conditions, “which would avoid any irreversible commitments” (pg. 4.18-85). The literature establishes that lek abandonments as a result of anthropogenic disturbance are not solely a product of displacement, but represent a population-level impact (i.e., population size will be negatively impacted; Hagen 2010, Naugle et al. 2011). Further, it has been demonstrated that population trends within relatively small management areas (e.g., BSUs) can differ from trends in the overall management unit (e.g., BLM Field Office; Edmunds et al. 2017), suggesting that an impact could be successfully mitigated at the site level, yet impacts may remain at larger spatial scales (e.g., impacts to a critical travel corridor between seasonal ranges; impacts to a regionally-limiting seasonal habitat type). Therefore, the long-term consequences resulting from short-term use and residual impacts could include the reduction or extirpation of sage-grouse from portions of or the entire Project area, and impacts could extend well beyond the boundaries of the Project area. Because of the philopatric behavior of sage-grouse (see Holloran and Anderson 2005), recolonization of abandoned areas may take multiple generations (Holloran et al. 2010), especially if these areas are large and/or geographically isolated from remaining populations. In contrast to the conclusions reached in the DEIS, the information presented in the DEIS under Alternative B establishes that the impacts to sage-grouse populations will more than likely be widespread. Further, although technically the impacts to sage-grouse populations will not be irreversible, I would contend that considering the impacts potentially irreversible and designing the development and compensatory mitigation plans to collectively guard against the risk of irreversible damage is pragmatic.

Cumulative Effects:--The purpose of cumulative effects analyses is to “ensure that federal decision-makers consider the full range of consequences of actions” when making decisions (pg. 5-1). This was pursued in the DEIS by estimating the cumulative habitat disturbed under Alternative B. Although the numbers presented in Table 5.3-34 appear to be incorrect [i.e., estimated cumulative habitat disturbed under Alternative B exceeds the total acreage of the Project area], Alternative B will more than double the surface disturbance in the Project and surrounding area based on terrestrial wildlife estimates (Table 5.3-28). As with other impact assessments, the DEIS establishes that specifics associated with cumulative effects will be addressed at time of APD (e.g., pg. 1-5). The site-specific scale at which the assessment of potential impact will occur establishes a situation where the cumulative impacts of development may not be realized until regional monitoring metrics suggest an adverse effect has already occurred (e.g., lek count-based metrics assessed at the scale of a BSU or BLM Field Office). Sage-grouse are a landscape species (Connelly et al. 2004), yet within this landscape sage-grouse rely on habitats with a diversity of species and subspecies of sagebrush interspersed with a variety of other habitats (e.g., riparian meadows, agricultural lands, grasslands) that are used by sage-grouse during certain times of the year (e.g., summer) or during certain years (e.g., severe drought; Connelly et al. 2011). The diversity of resources sage-grouse require seasonally and annually must be considered holistically to provide the large, functional, connected habitat patches necessary to sustain populations of the species. As suggested earlier, population trends within relatively small management units can differ from trends in the overall management unit, suggesting that regional-scale assessment metrics may not accurately depict what is occurring in smaller management units (and vice-versa) establishing a situation where the actual cumulative effects may not be noticeable at the local scale at which they are being assessed (Edmunds et al. 2017). This could result in regional-scale (cumulative) impacts to sage-grouse populations even in the event local-scale impacts are successfully managed. The approach to assessing impact through build-out scenarios described above (e.g., Copeland et al. 2009) would inherently address cumulative impacts, and this approach is encouraged.

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Mitigation:--The mitigation plan for sage-grouse establishes that "compensatory mitigation applied to the PHMAs must be considered for Alternative B to achieve a net conservation gain," (pg. 6-30) and the list of potential mitigation actions provided in the DEIS (section 6.6.2.2) are appropriate and sufficient for achieving this goal (and I applaud the innovative nature of the objectives established). The proof of course is in the results of pursuing these mitigation objectives. It is extremely important to note that the enhancement or restoration of sagebrush-habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations. Although managers often justify habitat manipulations with potential long-term benefits, the literature suggests that the long-term effects to sagebrush habitats and sage-grouse of most of the available habitat manipulation options are unknown or negative (Sage and Columbian Sharp-tailed Grouse Technical Committee 2009). Given the uncertainty surrounding proactive management of sagebrush habitats coupled with the need to pursue innovative management approaches to achieve the landscape-scale goals of the compensatory mitigation program (page 6-28), the <u>process</u> of how that mitigation program is developed, implemented and evolves is as important as the actual management actions outlined through the program.

Unfortunately, the general approach to compensatory mitigation described in the DEIS establishes temporal and spatial disconnects in the mitigation strategy; e.g., "the degree of the impact would be analyzed through desktop analysis and ground surveys conducted during future site-specific NEPA during the APD stage of development" (section 6.6.1). This suggests an approach to mitigation that will inadequately address the concerns raised in the preceding paragraph. Again because of the reliance on addressing impacts at the APD stage, impact assessments will be spatially limited and assessed near the time of impact, thereby limiting the ability to address landscape-scale goals and issues of timeliness. I strongly encourage the collaborative and coordinated development of a comprehensive compensatory mitigation strategy that closely adheres to science-based, adaptive management principles (Aldridge et al. 2004, Williams et al. 2009, Williams and Brown 2012). Science-based management requires the rigorous collection and recurring assessment of monitoring data and inclusive stakeholder community engagement, therefore a long-term (at least the life of the Project) commitment is required to implement an applicable compensatory mitigation program. The mitigation program could build from the infrastructure/refugia placement plan as informed through the build-out scenarios described above, and incorporate the weed management plan as an integral component of the compensatory mitigation strategy. In this way, a comprehensive strategy for developing the Project area adhering to Wyoming's sage-grouse conservation goals while providing for the development of the resource could be pursued.

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